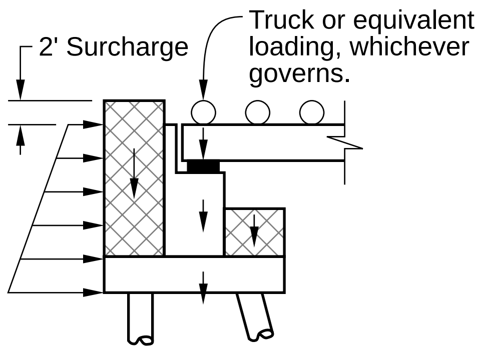
# ABUTMENT INVESTIGATION

## Non-Seismic Loads

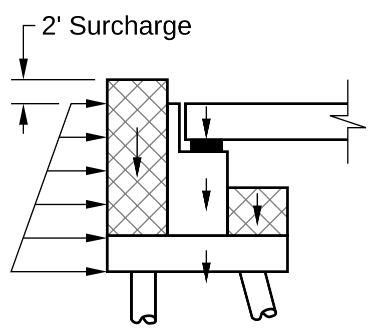
Abutments, whether founded on spread footings or piles, should be investigated for the cases shown below. A study of the conditions will often eliminate the necessity of investigation some of the cases.

**Abutment Design Loads (Service Load Design)**

| Abutment Design Loads | Case | | | | |
|---|---|---|---|---|---|
| | I | II | III | IV | V |
| Dead Load of Superstructure | X | X | | X | X |
| Dead Load of Wall and Footing | X | X | X | X | X |
| Dead Load of Earth on Heel of Wall including Surcharge | X | X | X | X | |
| Dead Load of Earth on Toe of Wall | X | X | X | X | |
| Earth Pressure on Rear of Wall including Surcharge | X | X | X | X | |
| Live Load on Superstructure | X | | | X | |
| Temperature and Shrinkage | | | | X | |
| Allowable Pile Capacity or Allowable Soil Pressure in % or Basic | 100 | 100 | 150 | 125 | 150 |

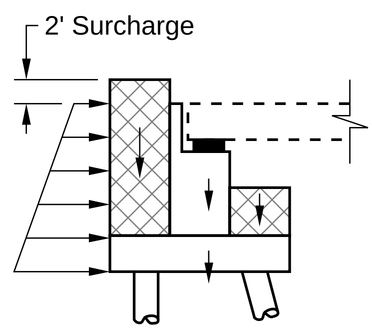



**CASE I**

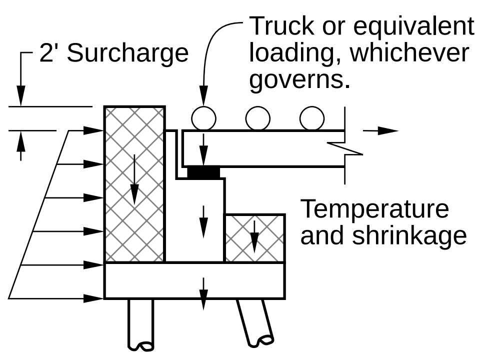



**CASE II**

Case II will govern only when live load reaction falls behind center of gravity of piles.

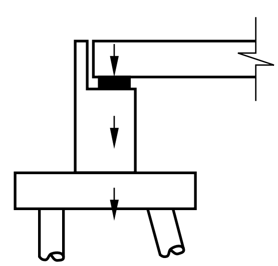



**CASE III**




**CASE IV**

Note: Also consider Case IV with no live load on superstructure.



**CASE V**

Case V will govern only when dead load reaction falls ahead of center of gravity of piles.

No horizontal earth pressure shall be assumed for the prism of earth in front of the wall.

Buoyancy shall be considered where it exists.

At abutments where the deck acts as a strut to support the earth behind the abutment, a note shall be placed on the plans to the effect that the backfill shall be placed simultaneously at both abutments after the deck is completed. For this strutted condition see Article 3.20.2 of *Bridge Design Specifications* for earth pressure distribution.

Refinement can be made in the calculations for Cases I and IV by omitting the 2' surcharge.

The rear piles or earth pressure at the heel of the footing shall be investigated for 75% of the active earth pressure (i.e., ka = 0.225 instead of ka = 0.30) in any and all cases.

**Minimum Lateral Design Force for Diaphragm Abutments**

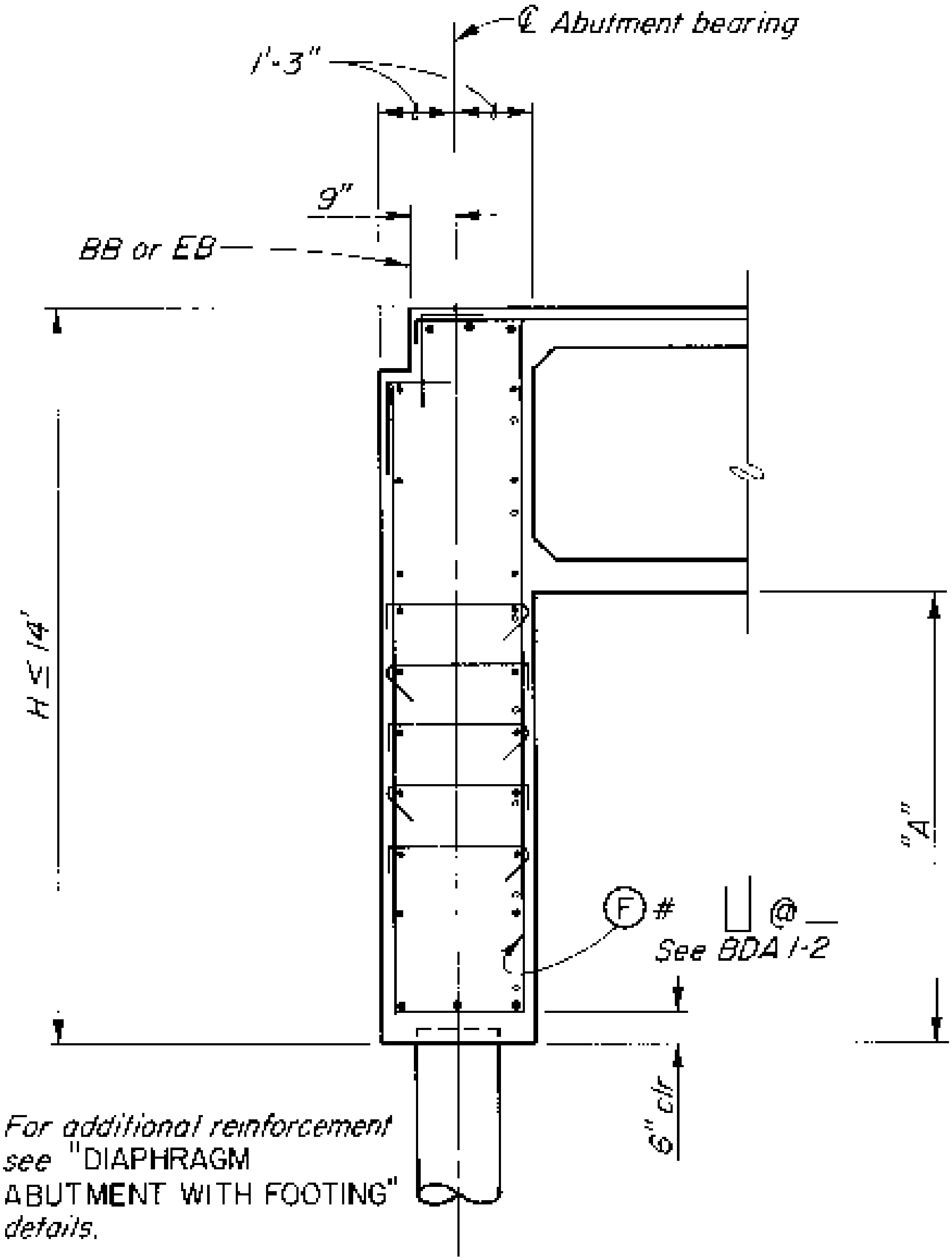
The values listed below for various vertical supports are minimum lateral design forces at service level applied at the base of the diaphragm abutment for determining the flexural reinforcing (F-bars).

| | Diaphragm Abutment Type | Minimum Design Force |
|---|---|---|
| Without Footing | Standard CIDH Piles | 25 kips per pile |
| | Standard Concrete Driven Piles | 20 kips per pile |
| | 45T & 70T Steel Piles | 15 kips per pile |
| With Footing | Neoprene Strip or Pads | 15% of Dead Load |

**(F) ⊔ Bars, 2'-6" Diaphragm**

| Lateral Force in Kips/L.F. | | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 | 7.0 | 8.0 | 9.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| "A" in Feet | 9 | #5@18 | #6@12 | #7@12 | #8@12 | #9@12 | #10@12 | #10@12 | #11@12 | #11@12 |
| | 8 | #5@18 | #6@12 | #7@12 | #8@12 | #9@12 | #9@12 | #10@12 | #11@12 | #11@12 |
| | 7 | #5@18 | #5@12 | #6@12 | #7@12 | #8@12 | #9@12 | #9@12 | #10@12 | #10@12 |
| | 6 | #5@18 | #5@12 | #6@12 | #7@12 | #8@12 | #8@12 | #9@12 | #9@12 | #10@12 |
| | 5 | #5@18 | #5@18 | #5@12 | #6@12 | #7@12 | #7@12 | #8@12 | #8@12 | #9@12 |
| | 4 | #5@18 | #5@18 | #5@12 | #6@12 | #6@12 | #7@12 | #7@12 | #8@12 | #8@12 |

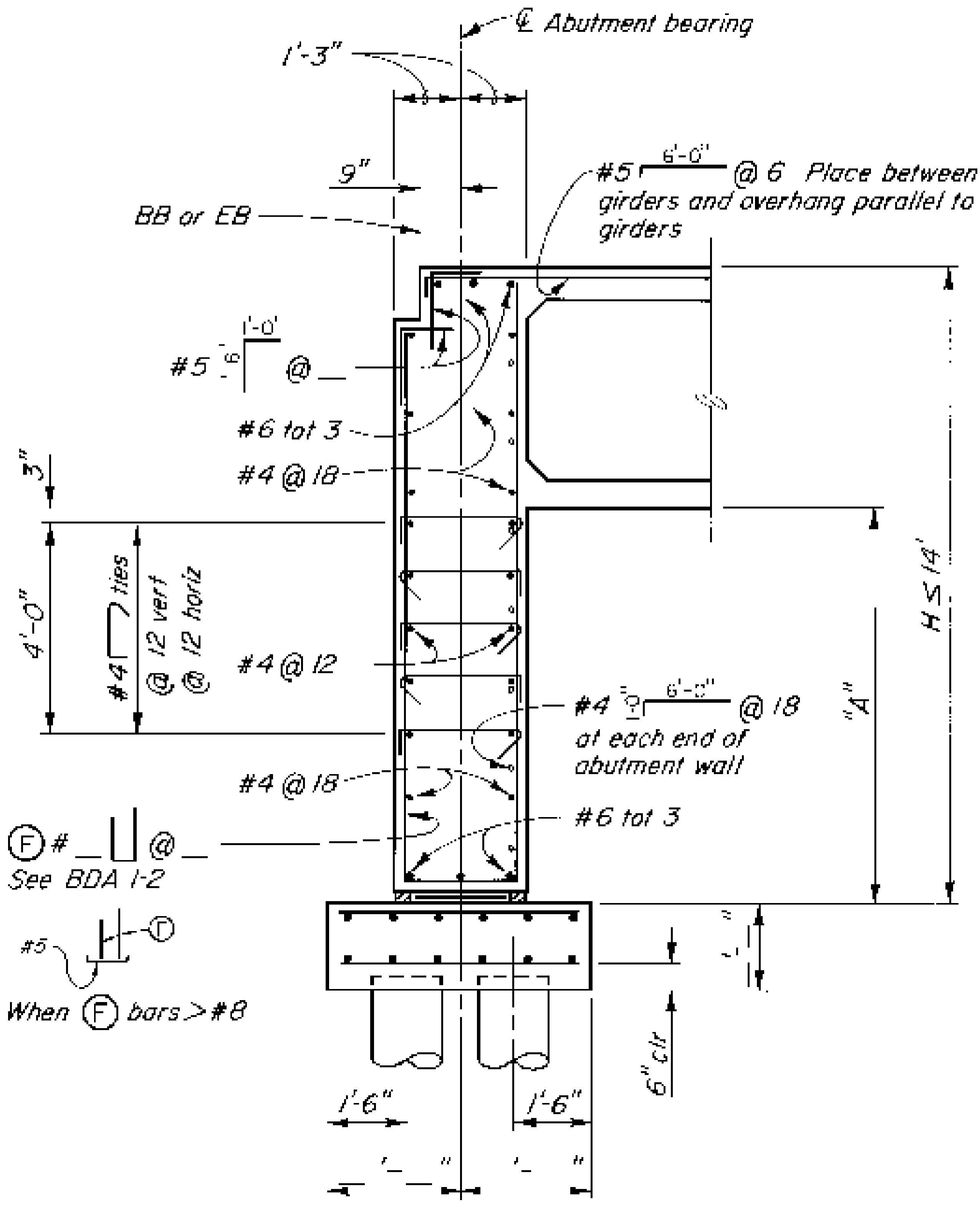
Note: If a diaphragm thickness is different from 2'-6" and/or flexural reinforcement is greater than that indicated in the last column of above table, the shear capacity of the diaphragm shall be investigated. The shear capacity of the diaphragm shall be sufficient to permit yielding of the flexural reinforcement.



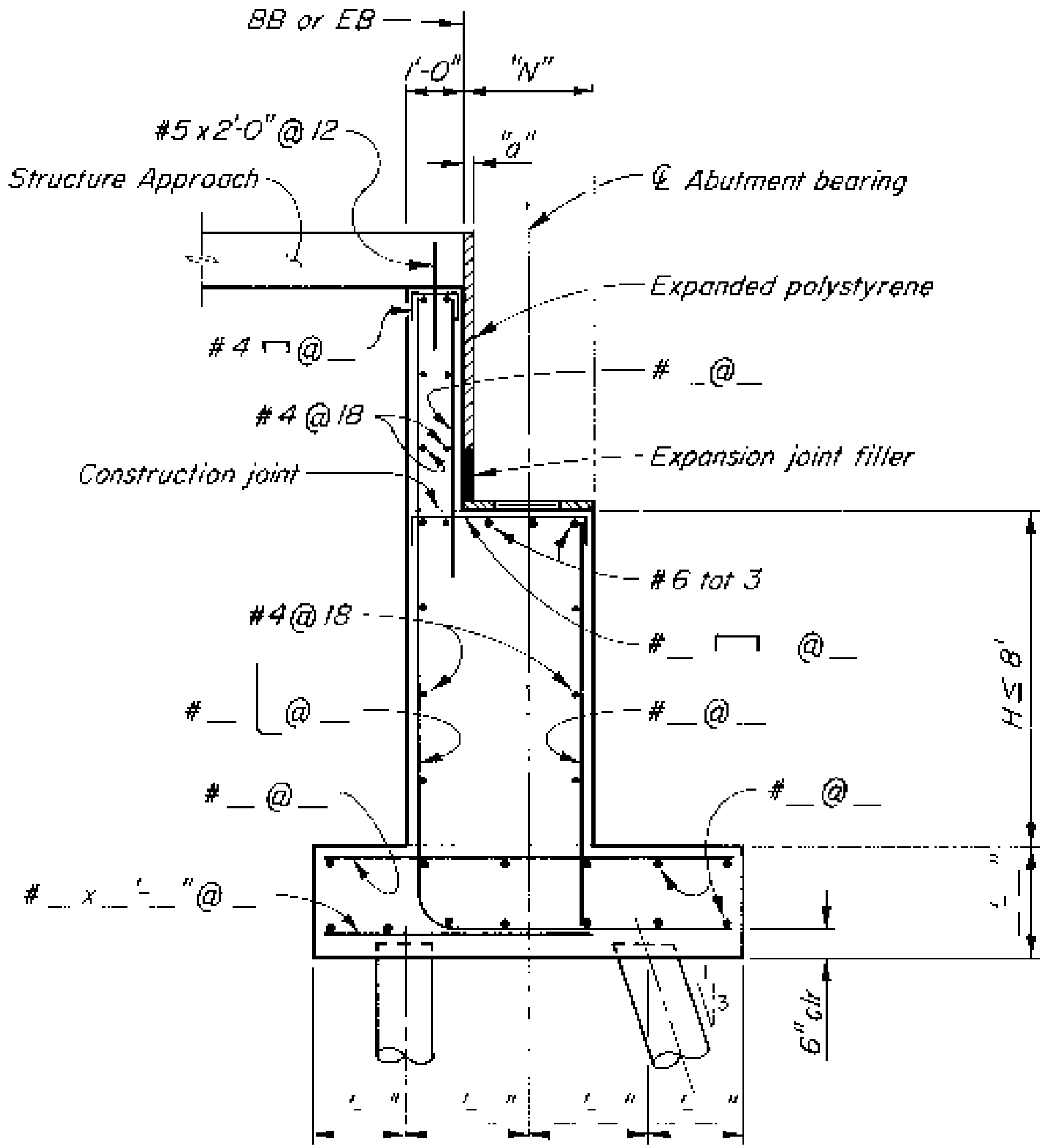

NOTE: *For additional reinforcement see* "DIAPHRAGM ABUTMENT WITH FOOTING" *details.*

## DIAPHRAGM ABUTMENT WITHOUT FOOTING

*NOTE: Do not use this abutment for prestressed bridges on concrete CIDH piles.*

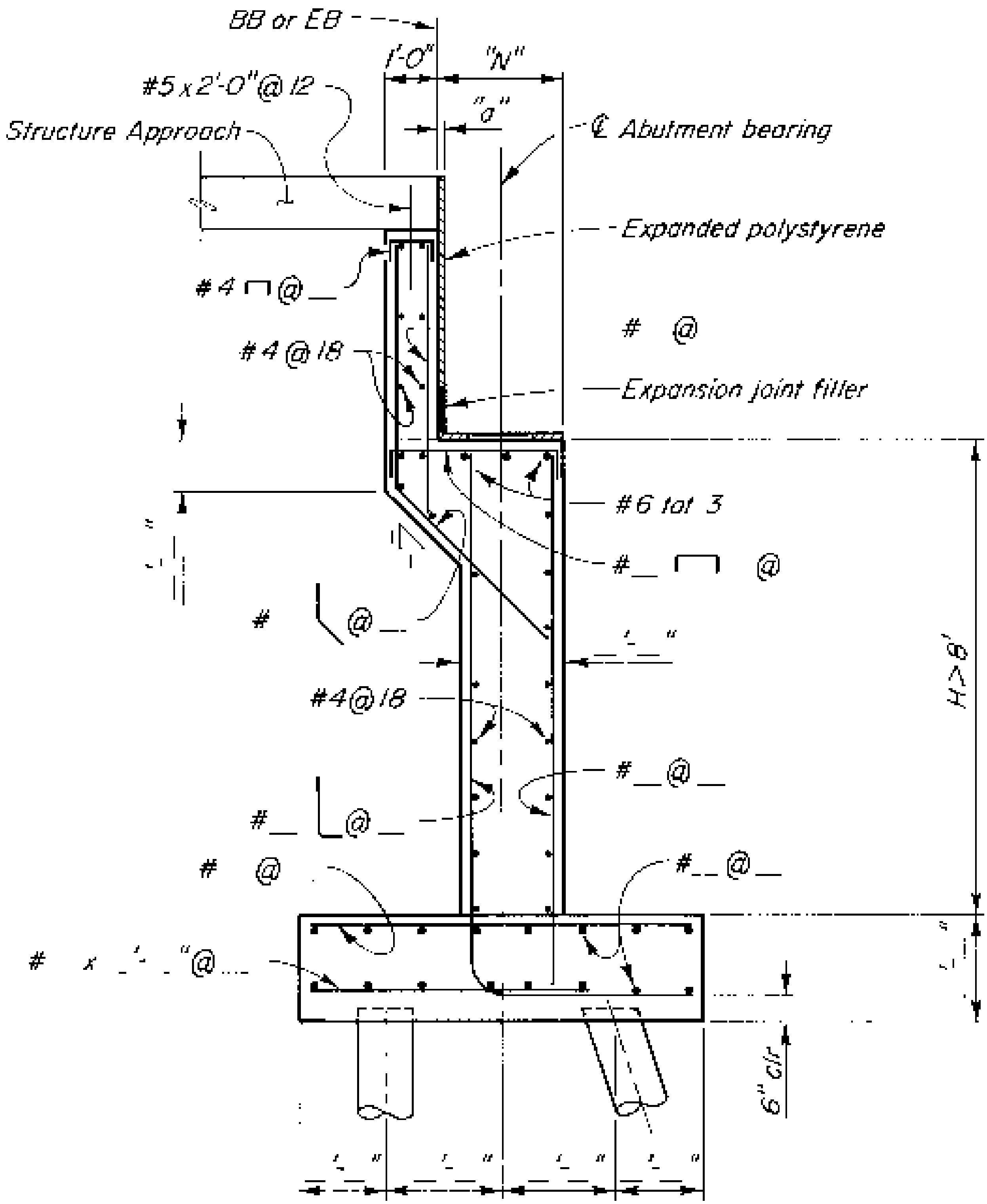



DIAPHRAGM ABUTMENT WITH FOOTING




## SHORT SEAT ABUTMENT

*NOTE: For support width, "N", see* "Memo to Designers 5-1".




## HIGH CANTILEVER ABUTMENT

*NOTE: For support width, "N", see* "Memo to Designers 5-1".